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Ammonia electro-static refrigerator

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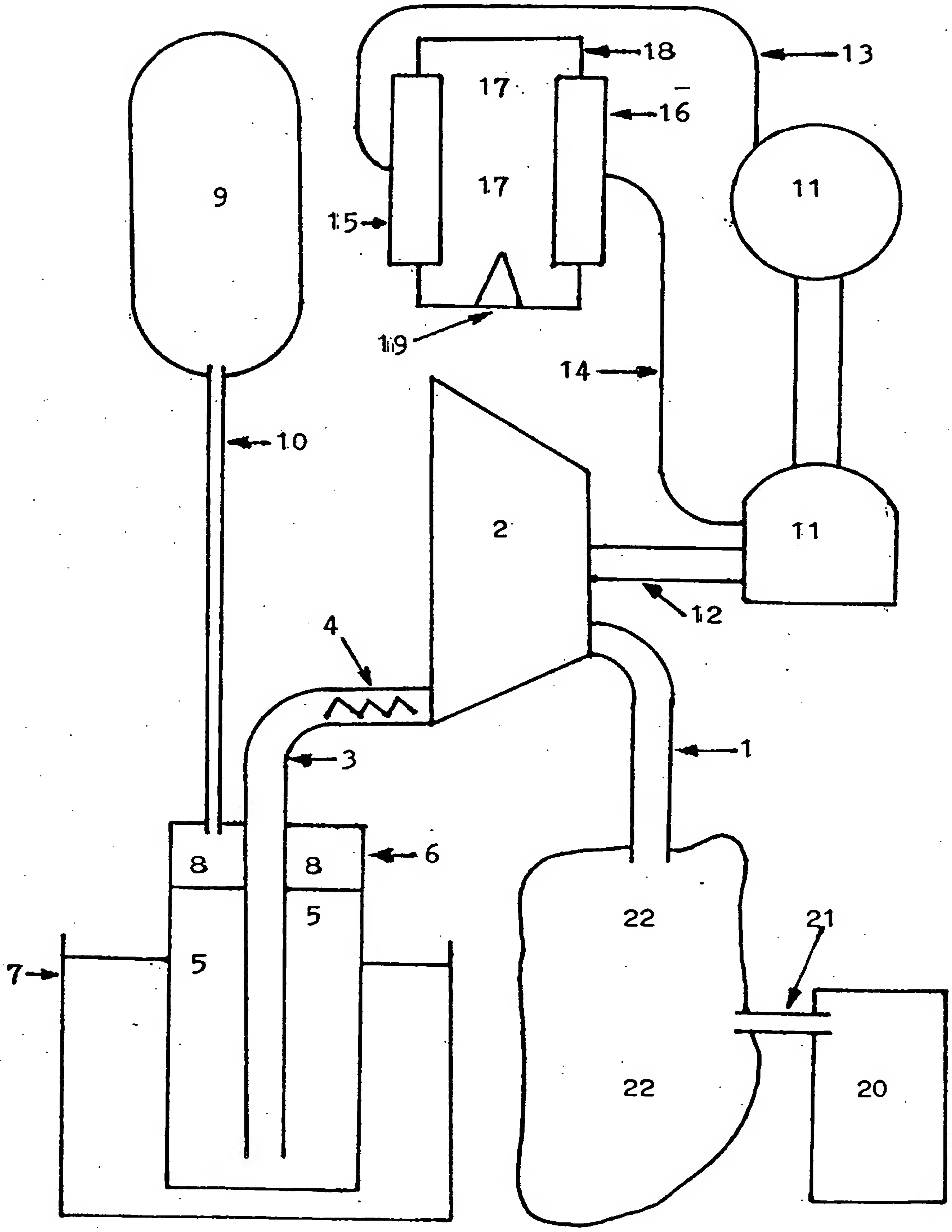
ABSTRACT

A simple gas expansion and regeneration cycle is disclosed. A turbine 2 processes ammonia gas from atmospheric pressure or greater down into a vacuum environment to be absorbed into a solution of water or chemicals for the production of energy and refrigeration. The absorption cylinder 6 is maintained at a low pressure by vacuum tank 9. Chemical solutions of potassium salts which under-go extensive hydrolysis are processed with an electric field in a chamber 18. The energy for this process is supplied by the expansion process or from earth field antennas. The cycle also operates from solar heat or industrial waste heat. The process is cyclic in nature where no gas is released into the atmosphere.

AMMONIA ELECTRO-STATIC REFRIGERATOR



COMPLETE SPECIFICATION
STANDARD PATENT

AMMONIA ELECTRO-STATIC REFRIGERATOR

The following statement is a full description of this invention, including the best method of performing it known to me:

AMMONIA ELECTRO-STATIC REFRIGERATOR

This invention relates to the production of refrigeration with low grade energy as a useful by-product by the expansion of ammonia gas from atmospheric pressure and ambient temperature down into a vacuum environment. Current technology usually employs concentrated solar heat to boil water or another volatile fluid for driving turbines for the production of energy and the expansion of a gas or vapour from a high pressure down to a lower pressure for the production of refrigeration.

An improvement in efficiency is proposed by this present invention by employing an absorbent solution which is able to absorb ammonia gas after an expansion process which allows an expansion turbine/engine to operate in a cycle which may be operated from several energy sources. At the exit of the expansion process a heat-exchanger removes refrigeration from the processed gas before this gas is absorbed into either a chemical solution or pure water. The absorbent solution is contained in a cylinder which is immersed in a water tank which constitutes a heat sink. The cylinder containing the absorbent solution is connected to a vacuum tank which is maintained at a low pressure allowing the expansion process to continue from atmospheric pressure. In one mode of operation a chemical solution of a highly soluble potassium salt is employed which under-goes extensive hydrolysis in water such as potassium meta-borate or potassium meta-silicate. When such solutions are exposed to an electric field two solutions are formed, one high in alkali content and the other high in acid content. The energy for this process may be taken from a high voltage generator driven by the ammonia expansion process or may be taken directly from the earths electric field with the use of earth field antennas.
In a second mode of operation pure water is employed as

the ammonia absorbent and a solar heater or any heat source from any industrial process is employed to displace the ammonia from the absorbent water through a heat-exchanger. The collected ammonia is then recycled back through the expansion process using the original absorbent water in a cyclic fashion.

To assist with understanding the invention reference is now made to the drawing which shows one mode of operation. To further assist this understanding it should be assumed that the cycle is in operation.

Pure ammonia gas is being delivered by pipe 1 to the expansion process 2 at atmospheric pressure and ambient temperature. Pipe 3 conveys the expanded ammonia at low pressure and low temperature below the surface of the absorbent solution 5. The heat-exchanger 4 removing the refrigeration from the gas stream before the absorption process. The absorption liquid is contained in a metal cylinder 6 which is immersed in a tank of water 7 which constitutes a heat sink. Cooling fins may be attached to the outer side of 6 but are not shown on drawing. Figure 8 represents a vacuum space above the absorbent liquid with cylinder 6 being connected to a vacuum tank 9 by a narrow pipe 10. Pure water and acid solutions absorb large amounts of ammonia gas with the production of heat and causing this gas to expand through a work process and then absorbing the ammonia in a vacuum environment will allow the established vacuum to be maintained. The drawing shows the expansion process driving a high voltage generator 11 via shaft 12. The high voltage generator is optional and may be replaced by earth field antennas which can draw energy for the processing of working fluids from the electric field in the earths atmosphere. Generator 11 is connected by insulated high voltage leads 13 and 14 to glass electrodes 15 and 16 which are immersed in a strong solution of potassium meta-silicate 17. The electrodes

are constructed of potash glass which are lined on the inside with small ball bearings. The electrodes are mounted in a plastic tube 18 with the positively charged electrodes at one end and the negatively charged electrodes at the opposite end. A valve 19 being located midway between the electrodes. The volume of this chamber 18 is approximately twice the volume of the solution held by 6. Recharge and drainage ports for chamber 18 and cylinder 6 are not shown on drawing. With the chamber 18 charged with a strong solution of potassium meta-silicate and the electrodes in operation to produce an electric field orthosilicic acid is drawn to the anode whilst the solution which is drawn to the cathode contains a higher concentration of potassium hydroxide. High voltage electrodes made of potash glass with a thickness of one to two millimetres do not polarise in this application. At the appropriate time in the cycle the solution is removed from cylinder 6 being high in ammonia concentration and mixed with the solution which has collected at the cathode end of chamber 18 in a mixing tank 20. The valve 19 being closed before the removal of any solutions from chamber 18. The mixing of these two solutions drives the ammonia gas out of solution as a gas which is collected and a strong solution of potassium meta-silicate is reformed. Ammonia gas is not soluble in a strong solution of potassium meta-silicate due to the caustic nature of this salt when dissolved in water. The solution remaining in chamber 18 which has collected at the anode end of the chamber is now re-directed back to cylinder 6. The mixing tank 20 is connected via pipe 21 to a flexible gas collection bag 22 which is also connected to pipe 1. Working solutions are removed and replaced in cylinder 6 in a fashion which does not cause the loss of vacuum in tank 9.

The solution of potassium meta-silicate which has been reformed in the mixing tank 20 is re-directed back to chamber 18 to be re-processed by the electric field.

In a second mode of operation solar or waste industrial heat is employed to drive the ammonia from pure water which constitutes the working fluid in cylinder 6. The transfer of this heat is through a heat-exchanger. This is not shown on drawing. The major components of this cycle are the turbine inlet pipe 1, expansion turbine 2, heat-exchanger for the removal of refrigeration 4, turbine exhaust pipe 3, absorption cylinder 6, heat sink 7, and the vacuum tank 9 and connecting tube 10. In this application the high voltage generator and components 13 to 22 are not required. The ammonia is driven from the pure water by the application of heat at the appropriate time in the cycle. The tank to displace the ammonia from the water by heat will require to be of sufficient mechanical strength as the operating pressures are greater than atmospheric. In the solar application the ammonia can be directed to enter the expansion process at a positive gauge pressure and expanded down into the vacuum region to extract the maximum work and refrigeration. A pressure regulator can be placed in the turbine inlet pipe 1 to regulate the ammonia pressure before expansion.

The claims defining the invention are as follows:

1. A simple ammonia gas expansion cycle where ammonia gas is expanded in a work process from atmospheric pressure or greater and then absorbed into water or chemical solutions under near vacuum conditions and then is expelled for recycling by the application of solar or waste heat or chemical reaction with the chemical separations being effected with glass electrodes powered by high voltage static electricity.

2. The ammonia gas expansion cycle of claim 1 where ammonia gas is expanded in a work process from atmospheric pressure or greater down to near vacuum pressures to be absorbed by water or acid solutions there-by permitting the continuous operation of such a cycle with-out the loss of the vacuum.

3. The ammonia gas absorption cycle of claim 1 where ammonia gas is expanded in a work process from atmospheric pressure or greater down to near vacuum pressures to produce refrigeration.

4. The ammonia gas expansion cycle of claim 1 where ammonia gas is expanded in a work process from atmospheric pressure or greater down to near vacuum pressures for the production of energy.

5. The ammonia gas expansion cycle of claim 1 which employs highly soluble potassium salts which under-go extensive hydrolysis when dissolved in water producing highly caustic solutions suitable as working fluids.

6. The ammonia gas expansion cycle of claim 1 which employs sealed glass electrodes made of potash glass lined on the inside with small ball bearings which do not polarise when immersed in potassium salt solutions when high voltage static electricity is applied to said electrodes.

7. The ammonia gas expansion cycle of claim 1 where-by solar heat or waste industrial heat is applied through a heat exchanger to expell ammonia gas from

the working fluid at atmospheric pressure or greater.

8. The ammonia gas expansion cycle of claim 1 where-by atmospheric electricity is drawn from the atmosphere with the use of earth field antennas and directed to power the high voltage electrodes of claim 6.

9. The ammonia gas expansion cycle of claim 1 where-by the gas expansion turbine drives a high voltage generator which provides the power to operate the high voltage electrodes of claim 6.

10. An ammonia gas expansion and regeneration cycle as described herein with reference to the accompanying drawing.

Michael Bunting. 11 January 2001.

AMMONIA ELECTRO-STATIC REFRIGERATOR